H₂S
(HYDROGEN SULFIDE)
SAFETY TRAINING
What is Hydrogen Sulfide (H2S)?

Where do you find H2S?

Properties of H2S

Detection of H2S

Protection against H2S hazards

How does H2S affect individuals?

Emergency Response and Rescue Procedures

Safety Measures

Proper donning, doffing, and storage of SCBA
What is Hydrogen Sulfide (H₂S)?

- A colorless (transparent) gas that is heavier than air and tends to accumulate in low-lying areas.
- Consists of 2 Hydrogen atoms and 1 Sulphur atom.
- Has an offensive odor similar to rotten eggs at low concentration, at higher concentrations it rapidly deadens the sense of smell.
- A poisonous gas that can paralyze the breathing system and can kill in minutes.
- Highly toxic and very corrosive to certain metals and elastomers.
- Belongs to the inorganic Sulfide family.
Other names referred to H2S:

- Stink Damp
- Rotten-Egg Gas
- Swamp Gas
- Dihydrogen Sulfide
- Hepatic Gas
- Zwavelwaterstoff
- Hydrogen Sulfide
- Sour Crude / Sour Gas
- Sewer Gas
- Hydrosulphuric Acid
- Sulphurated Hydrogen
Where do you find H2S?

**Natural Sources:**

H2S is produced in nature by the decomposition of organic materials by bacteria.

It may also develop in low Oxygen or low-lying areas and can be found with natural gas, petroleum and volcanic gases as well as unstabilized crude oil and gas streams.
**Industrial Sources:**

H2S is either a product or by-product of waste materials.

It can be found in familiar industries such as natural gas processing plants, petroleum refineries, leather tanning, pulp mills, iron and steel mills, oil and gas wells, sewage treatment, commercial laboratories, etc.
Properties of H2S

- **Soluble**: in water and dissolves in drilling fluids
- **Colorless or transparent**
- **Heavier than air** (Vapor Density = 1.1895) and accumulates in low-lying areas
- **Generates 680 BTU/HR during burning**
- **Flammable**: in concentrations between 4.3% and 46.0% and auto ignites at 500°F (260°C)
- **Corrosive**: to certain metals and elastomers
- **Highly Toxic and hazardous to health**
- **Flammable**: readily dispersed by wind movement or air currents
Burning $\text{H}_2\text{S}$ produces another toxic gas called $\text{SO}_2$ (Sulphur Dioxide)

Sulphur Dioxide ($\text{SO}_2$) is a colorless or transparent gas and is non-flammable. It is also heavier than air with a specific gravity of 2.264@0°C.

$\text{SO}_2$ is extremely irritating to the eyes and mucous membranes of the upper respiratory tract. It has exceptionally good warning properties in this regard than $\text{H}_2\text{S}$.

$$\text{H}_2\text{S} + = \text{SO}_2 + \text{other gases}$$
<table>
<thead>
<tr>
<th>Concentration</th>
<th>Physiological Effects</th>
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<tbody>
<tr>
<td>0.005 - 0.13ppm</td>
<td>Minimal perceptible odour</td>
</tr>
<tr>
<td>5ppm</td>
<td>Easily detectable, moderate odour TWA</td>
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<tr>
<td>10ppm</td>
<td>Beginning eye irritation</td>
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<tr>
<td>27ppm</td>
<td>Strong unpleasant odour, but not intolerable</td>
</tr>
<tr>
<td>100ppm</td>
<td>Coughing, eye irritation, loss of sense of smell after 2-5mins (IDLH)</td>
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<tr>
<td>200 – 300ppm</td>
<td>Marked conjunctivitis and respiratory tract irritation after 1hr of exposure</td>
</tr>
<tr>
<td>500 – 700ppm</td>
<td>Loss of consciousness and possible death in 30 minutes</td>
</tr>
<tr>
<td>700 – 1000ppm</td>
<td>Rapid unconsciousness, cessation of respiration and death</td>
</tr>
<tr>
<td>1000 – 2000ppm</td>
<td>Unconsciousness at once, with early cessation of respiration and death in a few minutes.</td>
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Detection of H2S

There are many ways to be alerted by the presence of H2S:

- Sense of smell (nose)
- Lead Acetate, Ampoules or Coated Strips
- Colorimetric Tubes (NIOSH certified)
- Electronic Portable or Fixed Monitors
- Wet Chemistry (Tutweiler method)
- Gas Chromatography

WARNING!!!

You cannot rely on your sense of smell to tell how much H2S is present....
Most alarms will consist of an amber strobe light, a blue strobe light, a red strobe light, and a dual tone audible alarm.

Types of Alarm:

**Low Level Alarm:** 10ppm

**High Level Alarm:** 15ppm and above

Note: Alarm set points can be adjusted to conform to local regulations or company requirements. Generally, the alarm points are set at 10ppm, 15ppm/20ppm. In some areas, they are set at 5ppm and 10ppm. It is critical to know what is required at your location.
Hydrogen Sulfide Condition Levels:

Δ **Condition Green “POSSIBLE DANGER”**

H2S concentration is **less than 10ppm**. Drilling and production operations are under control. There are NO alarms.

Δ **Condition Yellow “MODERATE DANGER”**

H2S concentration is **10ppm - 15ppm** at some point on location and the well or production stream is under control. Amber flashing light is activated.

Δ **Condition Red “EXTREME DANGER”**

H2S concentration is **> 15ppm** at any point on the location or loss of well control occurs. Amber flashing light and audible alarms are activated.
Two Common Types of Breathing Apparatus
(Respiratory Protection)

Self Contained Breathing Apparatus (SCBA)

This type of apparatus provides air from a cylinder worn on the back. A commonly used cylinder will supply air for 30 minutes while the wearer is engaged in heavy physical work. Other cylinders are available for longer or shorter usage. Duration of air supply is dependent on the type of work performed and the individual’s physical condition.

Supplied Air Breathing Apparatus

This is a variation of the self-contained breathing apparatus where the back-mounted tank is replaced by a large cylinder connected by a hose line to the pigtails on the BA set. While the supplied air apparatus is lighter to wear, it restricts the user’s movements to the length of the hose. The hose also forces the user to return by the same route taken when entering the area. An escape bottle must be worn with this type of apparatus.
Special Problems in Respirator Use:

- Facial Hair
- Contact Lenses
- Corrective Spectacles
- Psychological Disturbances
- Miscellaneous Sealing Problems

"Not everyone can wear a respirator"

Prior to being allowed to use a breathing air equipment, the worker must have medical clearance and have been properly trained to wear respiratory protection.
How does H2S affect Individuals?

Factors that determine the effect of H2S on individuals:

- **Duration**
  The length of time the individual is exposed

- **Frequency**
  How often the individual has been exposed

- **Intensity**
  How much concentration the individual was exposed to

- **Individual Susceptibility**
  The individual’s physiological make-up
Target organs subject to the effects of H2S:

- Olfactory Nerves
- Lungs
- Eyes
- Brain
- Respiratory Control Center

Entry into the Body:

- Ingestion
- Injection
- Skin Absorption
- Inhalation
Emergency Response and Rescue Procedures

These are the basic steps to take if you are in the immediate area of spill or leak.

- **DO NOT PANIC!**
- Hold your breath
- Move upwind or crosswind and away from the gas
- Put on appropriate breathing apparatus
- Assist anyone in distress
- Move quickly to the upwind “Safe Briefing or Assembly Area” to receive instructions.

Always follow company policies and procedures for escape and rescue. Before attempting to rescue anyone else, always:

- **Protect yourself first.** Don’t become another victim.
- Put on rescue breathing apparatus (30 mins. SCBA) before attempting a rescue.
- Use the “Buddy System”. Do not attempt to rescue anyone alone.
“EVERYONE SHOULD KNOW WHAT HIS OR HER RESPONSIBILITY IS, IN THE EVENT OF AN H2S EMERGENCY SITUATION.”
No job is so important and No service is so urgent – that we cannot take time to perform our work SAFELY...
SAFETY FIRST
THANK YOU